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OSI Contribution to NIE-64 (Part I)

"SCIENTIFIC AND TECHNICAL FACTORS AFFECTING SOVIET BLOC CAPABILITIES FOR MILITARY WARFARE" *

A. General Assessment of Soviet Bloc Scientific and Technical Capabilities

1. The time lag required to translate scientific and technical progress into increased military capability is generally long. Consequently, Soviet Bloc science and technology, while a factor to be considered by the Kremlin in its war plans, are not likely to produce general effect in military force in the period of the estimate. However, the Soviets must consider the current capability and potential of Soviet Bloc science-technology as being one of the factors required to support a war effort over a period of time.

2. Quantity

5. Effect of Ideology

Communist ideology has not deterred military research and development. While it is true that there have been attacks on a wide range of theories in physics and chemistry as well as in biology there are no indications to date that ideological attacks have been permitted to hamper developments directly affecting military capabilities. In biological theory, especially in genetics, where rigid dogmatic lines have been laid down, the damage has been most severe; it is possible that the effect of this damage could cause a lag in agricultural development and thus affect future war potential beyond the period of the estimate.

6. Foreign Information Acquisition

The USSR has profited greatly from the knowledge gained by industrial-pioneer nations. The USSR has fully exploited Western ideas, techniques, processes, and equipment in building its technological machine. It has thus gained time and reduced expenditure of funds and materials. Moreover, as Soviet technology continues to expand, it depends less on Western knowledge and more on its own scientific ability. While the USSR will probably always capitalize on foreign development where desirable, we believe there are few, if any, areas of science in which the USSR must have foreign information available in order to progress. In some fields, notably micrometeorology, high-power radio stations, communication jamming, applied mathematics pertaining to analogue computers, cosmic ray research, and others, the USSR possibly now excels all other nations.

7. Satellite Contributions

East German science no longer has any unique capabilities to offer to Soviet weapons development. Immediately after the cessation of hostilities in Europe, the USSR gained an important advantage by exploring German knowledge of new weapons, especially in the field of guided missiles. Soviet weapons development in many fields has now progressed sufficiently that the USSR has returned large numbers of Germans who were invited or taken to the USSR after World War II. In East Germany and Czechoslovakia, and to a lesser extent in other Satellite countries, the USSR possesses reserves of scientific and technical manpower and facilities, industrial equipment, precision instruments, and raw materials, including a major portion of the Soviet supply of uranium. *

8. Conclusions

Soviet Bloc research and development, already at a high level, is increasing in scope and effectiveness. While the total sum of achievements of Soviet Bloc science and technology is still on a level below that of the Western Powers, technological growth is progressing at such a rate that the gap between the two technologies is diminishing. The ability of Soviet

* It is estimated that East Germany has supplied 35-40 per cent of the Soviet uranium and that Czechoslovakia, Bulgaria and Poland together have supplied 20-25 per cent.

research and development to comprehend and adapt foreign science and technique to Soviet needs implies a technical level approaching that of the countries imitated. Bloc military capabilities are rapidly affected by science and technology. Centralized planning and control compensate for any general technological lag, for the USSR can concentrate research and development on particular problems of strategic importance. First priority in research and development is placed on items of military significance, notably atomic energy. With the notable exception of plants for developmental projects in the fields of atomic energy and guided missiles, which are well dispersed, the majority of research and educational institutions are concentrated in the Moscow and Leningrad areas and consequently would suffer from attacks on those areas. However, Soviet scientists have demonstrated unusual capacity to work under extremely adverse conditions, and possibly might offset much of the effect of attack through this ability.

9. Quality

The Soviet scientific-technical pool includes scientists and technicians of varying degrees of competence. During the period of expansion in the early nineteen-thirties, scientific organizations were filled in many cases with inadequately trained and often incompetent people. Since the fill-up, there has been increasing emphasis on quality. In recent years standards of higher educational institutions in most scientific fields have risen to the point where they are comparable to Western standards. In the past many Soviet engineers and technicians have tended to be strong theoreticians, while exhibiting weakness in their ability to apply their knowledge to concrete situations. At present, however, the Soviets are rapidly bridging the gap between theory and its application, and the rapid advance of Soviet technology, especially during the past five years, is evidence of an increasing mastery of practical "know-how." Development in the electronic field is the most obvious evidence, while the MIG-15 is testimony to technical development in the aircraft field.

B. Capabilities in the Most Important Fields

10. The application of science-technology to military problems has been an outstanding success in the Soviet Bloc, primarily in the USSR. The achievements in atomic energy, aircraft design and production, electronics and other significant fields testify to the effectiveness of the application. Bloc military capabilities are continually being increased over those of 1945 as a result. The most significant advances compare very favorably with Western advances, in some cases exceeding them, and in others lagging from 1-4 years.

11. Atomic Weapons

General. The USSR is the only Bloc nation believed to have weapon capability in this field. In that country, the AE program, large and fully integrated into over-all Soviet security planning at the highest level, enjoys

a priority second to no other program. Satellite contribution is principally as suppliers of uranium ore, although they have rendered other support. Eastern Germany has supplied about 35-40% and Czechoslovakia-Poland about 20-25% of the uranium used or stored by the Soviets. Supply of these proportions is likely to hold through mid-1953 and it is estimated that the total uranium supply available exceeds current Soviet requirements.

12. Fissionable Weapons

We believe that Soviet weapon technology has progressed to the point where atomic weapon models stockpiled can be determined by military requirements, including those involved with actual delivery, rather than technological limitations. The Soviet Union is now capable of the quantity production of two types of fissionable material; uranium-235 and plutonium. It has demonstrated that it can utilize this material to make effective atomic weapons. The atomic weapons available as of mid-1952 should be capable of developing from 30 to 50 kilotons TNT equivalent explosive power, and the Soviets should have little difficulty in making weapons developing only a few kilotons or up to 100 kilotons by mid-1953.

13. Thermonuclear Weapons

We believe it unlikely that the Soviets will be able to develop and produce a practical thermonuclear weapon prior to mid-1953. While it seems almost certain that scientific problems pertaining to the development of thermonuclear weapons are being investigated by the Soviets, the information available does not permit an assessment either of the emphasis placed on this work or of the progress being made. New approaches to the thermonuclear weapon problem cannot be ruled out, but there should be some detectable indication of such efforts in weapons tests prior to the production of stockpile models. None of the three Soviet weapons tests have shown any indication of the development of thermonuclear weapons.

14. Power and Propulsion

While little is known about the Soviet program for the development of atomic energy for power and propulsion, there are indications of relevant research and vague indications that long-range plans may include such development. However, we do not believe that Soviet atomic power developments will be militarily significant before mid-1953.

15. Radiological Weapons

It is most unlikely that the Soviet Union will have the capability to produce militarily significant quantities of radiological warfare agents, although she will have available small quantities of RW agents in the form of gross or separated fission products which might be employed primarily for their psychological effect.

16. Biological Weapons

There is no definitive evidence of a Soviet BW program. We believe, however, that a biological warfare program exists for the Soviet Bloc has the personnel, institutions and equipment to maintain a research and development

program in the field, and the advantages of BW are apparent.

17. The USSR is capable of employing biological warfare against man, animals and crops. Sabotage and clandestine attacks against all three are well within Soviet capability; large-scale BW attack is possibly within Soviet capabilities. It is unlikely that the Soviet Bloc will utilize against man and animals pathogens other than those widely recognized as most promising by Western nations. It may be able to select especially virulent strains of these pathogens. Regarding biological warfare against crops, nothing is known of Soviet plans or programs.

18. Antibiotics

Some effective chemotherapeutic and other counteragents for AW, BW, and CW such as the sulfonamides and penicillin are believed to be available adequately to supply the armed forces, war workers, and possibly other selected personnel. Research on, and development and production of other counteragents, such as new antibiotics, are known to be subjects of concerted effort, with results that are increasingly productive.

19. Immunization

The Soviets probably have effective immunization capabilities against some potential BW agents such as Pasteurella pestis and Bacterium tularense. These vaccines or sera would probably be available in adequate quantities to protect the armed forces, war workers and other selected personnel; we cannot estimate whether or not all persons could be protected nor can we estimate the validity of Soviet claims for immunization capabilities against several other agents.

20. The highly organized public health and civil defense systems of the USSR could provide at least minimum essential services in event of AW, BW or CW attack.

21. Chemical Weapons

The Soviet Bloc is well prepared to wage chemical warfare. The stocks of World War II standard agents and equipment have probably been maintained in a militarily usable condition and have been augmented by at least one German nerve agent. A major chemical warfare offensive could be sustained, including limited use of nerve agents against either several major cities or ground troop concentrations. The weapons system which may be used is believed to be virtually the same as that of World War II. Dissemination could be accomplished by aircraft or ground weapons. The Soviet Army is believed to be provided with adequate protective equipment.

22. Electronics Equipment

We estimate that recent developments in Soviet Bloc electronics will result in the following capabilities during the period of the estimate:

a. The present effective radar detection network will be supplemented by improved EW radars, with performance equivalent in all respects to U.S. operational equipment, deployed in limited quantities.

b. Operational quantities of effective airborne interception equipment for use in all-weather fighters will be available.

c. Effective fire-control radar and directors for AA fire, both ground based and shipborne, will be in operational use, protecting the strategic targets in the USSR.

d. Electronic countermeasures equipment, both active and passive, for frequencies up through the UHF (300-3,000 Mc/s), and possibly in the SHF (3,000-30,000 Mc/s), will be in limited operational use.

e. Artillery type proximity fuzes may be in operational use.

f. A radar aircraft landing system facilitating all-weather flying may be in limited use.

g. A radio navigational aid system providing both long and precision short-range coverage may be in regular operation although perhaps on a limited scale.

h. Radar-absorbent camouflage for radar targets may be available.

i. High quality vacuum tubes will be available although in limited types.

j. Anti-sonar coating materials for submarines and mines will be available although quantities cannot be estimated.

k. Continued ability to jam at will all radio transmissions from the West over Soviet Bloc territory and extension of this jamming to long-range communications not intended for Bloc Territory reception.

23. Guided Missiles

There is no reliable recent information concerning the aim or scope of the Soviet guided missile effort, but limited intelligence indicates that air defense missiles enjoy very high priority (the Soviet air defense program is believed to have a priority second only to the AE program).

24. There has been no evidence of a departure from the comprehensive German wartime designs of the V-1 and V-2 type missiles. We believe that no purely Soviet designed missiles will appear operationally prior to mid-1953; developments of, or copies of, the German types may be encountered. Missile propellants are available in operational amounts in the U.S.S.R.

25. Surface to Air Missiles

Quantities of the German subsonic Schmetterling and supersonic Wasserfall missiles could be available for operational use well prior to mid-1953. A

Schmetterling missile would have reasonable capabilities against propeller-driven aircraft and the Wasserfall missile against all presently envisaged types of nuclear weapon carrying aircraft. Target observation could be by optical and/or radar means, and missile control by radio or radar command, or by radar beam riding. Radar guidance (estimated maximum ((Wasserfall)) missile range of 50,000 yards at 60,000 feet altitude) may be by the Soviet version of the U.S. SCR 584 type radar. Terminal guidance by infrared homing is believed to be within the capability of the USSR well before mid-1953.

26. Air to Surface Missiles

There is no intelligence concerning specific improvements in the German missiles of this type, although there is known Soviet interest and Soviet studies and tests have been accomplished. The Soviets are capable of adding radar target observation before mid-1953; a television guidance system may be available during the period of the estimate.

27. Surface to Surface Missiles

Improved subsonic V-1 and supersonic V-2 type missiles with estimated ranges of 250 and 300 miles, respectively, and with guidance considerably improved over World War II standards could be available in operational quantities prior to mid-1953. A modified V-1 with one or two pulse jet engines could be adapted to carry a nuclear energy war head within the period of this study. There is no reliable evidence concerning submarine launching of V-1 type missiles, but it is well within Soviet capabilities at any time in this period. The USSR could have a ground launched anti-tank guided missile similar to the French adaptation of the German air-to-air missile, X-4.

28. Air to Air Missiles

The USSR obtained full data on German subsonic X-4 and HS-298 missiles during the initial exploitation period. Although we have no evidence of continued work on this project, it is possible that the Soviet Bloc could have, prior to mid-1953, sufficient subsonic air-to-air missiles for operation against propeller driven aircraft and a version of a super-sonic infrared homing missile for use against all contemplated bomber types.

29. Aerial Weapons: Bomber Aircraft

The Type 31, the only Soviet heavy bomber, will probably be operational in limited numbers by mid-1953. It may be powered by turbo-prop engines. The Long Range Air Force will continue to rely principally on TU-4 aircraft. A twin-jet medium bomber prototype, the German-designed EF-150, could be available in very limited numbers in mid-1953. Two twin-jet, straight-winged light bombers, Types 27 and 35, will be standard equipment through mid-1953, replacing the obsolete TU-2 and PE-2 light bombers.

30. Fighter Aircraft

The MIG-15 will be retained as the standard fighter through mid-1953, though it is probable that an afterburner-equipped version with significant improvement in performance characteristics will exist by that date. The Types

8, 15, 16 and 28, the MIG-9, and the Yak-15 presently exist in limited numbers but will not be of much importance by mid-1953. It is probable that one or more new type fighters such as the Types 18, 19 or 21 will be available in operational quantities by mid-1953. There is very limited evidence of Soviet all-weather interceptors. Possible candidates are the MIG-15 or the Types 18, 19, and 21. The latter three airplanes were initially observed with radome-like beaks over the air intakes. It is probable that a twin-jet all-weather interceptor such as the Type 17 will make its appearance during this period.

31. Attack Aircraft

The MIG-15 will probably be used primarily for close support operations, replacing the obsolescent IL-10, while interdiction missions will be handled by the Types 27 or 35.

32. Transport Aircraft

During the period of this estimate, the twin reciprocating-engine models IL-2 and IL-12 will exist in quantity, while the IL-18 and the TU-70 four-engined transports will probably be available in limited numbers by mid-1953. The AN-2 single-engined liaison transport will be in service use during this period.

33. Aircraft Engines

The turbo-jet engines RD-45 and VK-1, which power the two known versions of the MIG-15, will continue in use through mid-1953. They are rated at 5,000 and 6,000 pounds static thrust, respectively. Engines now in the development stage, which could be in limited production by mid-1953, are the German-designed JUMO 012, and the Soviet-designed Mikulin and Lyulko engines. The first is believed to have a static thrust rating of at least 6,600 pounds while the latter two were reportedly designed for about 10,000 and 11,000 pounds, respectively. The only known turbo-prop engine in the development stage is the JUMO 022, which reportedly has passed its acceptance tests at a rating of about 5,000 shaft horsepower plus about 1,000 pounds static thrust. The JUMO 224 diesel engine may be under development, and may possibly be installed in the Type 31 bomber as an interim power plant. It is rated at about 4,000 horsepower and is not considered satisfactory for an airplane of this size and weight.

34. Armament

A definite program to mount larger gun-type weapons for both bomber and fighter is underway. The most used weapons are the NS-23mm and the N-37mm cannons. Further developments toward higher rates of fire and better ammunition are expected. Use of air-to-air unguided rockets of sizes about 50mm and 70mm is known. There have been some indications of larger operational rockets; these might incorporate infra-red seekers prior to 1953. Conventional bomb development in tactical sizes for high speed external stowage, with improved fuzing, particularly for anti-personnel types, can be expected.

35. Equipment

Soviet aircraft are less burdened with equipment than their U.S. counterparts. Soviet aircraft, however, use essential equipment such as ejection seats, cockpit pressurization, and external auxiliary fuel tanks. It is likely that by mid-1953, the USSR will also adopt air-to-air fueling techniques.

36. Land Combat Weapons: Tanks (Including Self-Propelled Guns)

During the period of the estimate, the bulk of the Soviet effort in tanks will be along conventional lines. It is possible that a replacement for the T-70 light tank for reconnaissance or airborne operations may be in an advanced state of development. There are indications that development work in the medium tank field has progressed to the point which would permit the Bloc to go into immediate quantity production anytime prior to mid-1953 on a medium tank possessing combat characteristics measurably superior to the T-34/85. In the heavy tank field, it is considered likely that much of the total current effort is being devoted to improving the JS-3 series and that such a model of this series could be placed in production within this period. It is doubted that a completely new heavy tank will appear prior to mid-1953.

37. It is possible that a self-propelled gun design has been developed concurrently with the new medium tank chassis mounting either an improved 100mm or medium howitzer. In the heavy field, there is some possibility that a 172mm gun similar to the German 17cm K-18 may be mounted on an improved JS-3 chassis.

38. Artillery

Although some developmental work is being carried on in Czechoslovakia, indications are that this effort will be phased into the over-all Soviet program. In field artillery, it is possible that a new piece based on the German 17cm K-18 may be in an advanced state of development as a replacement of the current 152mm M1935 and the 210mm M1939. Work on artillery-type unguided rockets will probably be restricted to improving range, fire control, and loading techniques. It is likely that a recoilless gun for infantry support and airborne use may appear during this period.

39. Anti-tank

While Czechoslovakia is contributing some support in the development of improved anti-tank ammunition and rocket propellants, primary development work is being done in the USSR. It is possible that the USSR may have improved versions of the 57mm AT gun and the 100mm Field/AT gun. It is probable that during the period of this report, the major effort will be concerned with improvement of ammunition and fire control items. There are indications that three new infantry anti-tank weapons have been issued to troops. These weapons are believed to be a Panzerfaust-type with non-expendable launcher, a Panzerschrecht or Bazooka type, and a wheeled, recoilless weapon firing fin-stabilized rockets.

40. Mines

It is probable that a number of non-metallic mine types, including some items apparently employing the shaped-charge principle, are in an advanced state of development both in the USSR and in Czechoslovakia. It is probable that concurrent fuze developments will include items utilizing magnetic, vibration, and possible frequency induction techniques. Although there is no evidence of a non-metallic mine detector development program, both the USSR and Czechoslovakia are known to be concerned with the progressive development of metallic detectors. There is no definite evidence of a high priority program for mine field clearance.

41. Bridging

There are indications that a prefabricated tactical bridge similar to the "Bailey" type is in an advanced state of development or in limited production. It is possible that a bridge of this nature will be available at least in limited quantities before mid-1953. Considerable interest is also centered on the development of power-driven rafts and assault craft.

42. Small Arms

It is possible that an entirely new light machine gun based on the German MG42/45 and using a rimless cartridge may be ready for limited operational use. A logical counterpart, a new semi-automatic shoulder weapon, employing the same cartridge, may also be at the same stage. Czechoslovakian potential in this field seems to be restricted to work on machine pistols and rifles. The Chinese will probably, during this period, continue to copy with minor innovations, the designs of other nations.

43. Antiaircraft Artillery (Including Rockets)

The reported issue of a 57mm gun and a 100mm gun in advance of previously estimated dates tends to support the conclusion that the Soviet antiaircraft capability has increased measurably since World War II. Until mid-1953, Soviet developments in the medium and heavy weapons categories will probably be confined to improvement of ammunition, increasing the rates of elevation and traverse, and refinements of the fire control systems. There is insufficient evidence to estimate the state of development in the light weapon or rocket category, though the Bloc must be considered to have the capability to develop and produce a light weapon for field support of the troops and an unguided antiaircraft rocket equal or superior to the German Taifun.

44. Special Arctic Equipment (Ground)

Insofar as weapons are concerned, indications are that during this period, Soviet efforts will continue the policy of adapting current items to Arctic conditions. Conventional development of significant items such as mechanical snow removal and compacting equipment, mobile power generating plants equipped with gas converters, full-tracked vehicles for sustained operation over snow, and ice-breaker ships will be continued.

45. Naval Weapons: General

Satellite contributions to the Soviet Bloc naval effort will, except for small craft, be negligible. While a major [illegible]

progress in some classes of ships, only a moderate portion of the full known shipyard potential is involved. By the end of the period of this report, such an all out effort could be initiated, but there are no indications that such will occur.

46. Surface Vessels.

A major post-war construction program in cruisers and destroyers is presently underway. The design trend of this program has been towards increased length and displacement in order to increase endurance, improve sea-keeping characteristics, and permit increased antiaircraft firepower. There are no firm indications of newer designs to be constructed prior to mid-1953.

47. Large numbers of destroyer-escorts, patrol craft, and minesweepers have been built, but no evidence exists of large scale construction of amphibious craft or midget units. There are no indications of current construction of hydrofoil craft, but work done with German designs would allow large scale production to be initiated within the period of this report.

48. There are no indications of advanced concepts in Soviet surface ordnance. Modern installations appear roughly comparable to those of U.S. vessels of World War II design. It is unlikely that significant improvements will be made prior to mid-1953.

49. Submarines

A new submarine prototype will probably appear about mid-1952 and limited serial production may commence with the first boats operational by the end of the period. This new submarine will probably be a medium sized, ocean patrol type with characteristics somewhere between the conventional boat and the modern high-speed type. The vessel will be of simple, rugged construction adaptable to mass production, will employ snorkel and carry mines and/or torpedoes. There is no reliable evidence concerning submarine launching of V-1 type guided missiles, but it is within Soviet capabilities to do so at any time in this period. While development work has been carried on with a Walther(Hydrogen peroxide) cycle propulsion plant, and a prototype is probably now available, there is no evidence that high priority has been accorded the project and such a plant is not expected in operational quantities in this period. Concentration on nuclear propulsion is a possibility, though project completion would not be reached by mid-1953.

50. Satisfactory German midget submarine designs are available to the Soviets, but there are no indications of development or production at this time.

51. Underwater Ordnance

By mid-1953, Soviet operational torpedoes probably will have standard steam or electric propulsion, passive acoustic homing, magnetic exploders, and a pattern running device. Development will continue toward wakeless propulsion systems, passive and active homing devices, influence exploders, wire-control guidance, and pattern running devices.

52. By mid-1953, the Soviets will have operational effective moored contact mines, a ground magnetic induction mine of increased sensitivity, a pressure-actuated ground mine, and combination mines employing these two firing mechanisms.

C. Effects on Tactical and Strategic Concepts

53. The possession of atomic weapons for delivery as bombs with yields of 30-50 kilotons is definite; possession of atomic weapons with yields up to 100 kilotons is probable; atomic weapons for tactical use, missile warheads, submarine mines, and for clandestine delivery are possible during the period of the estimate. Thermonuclear weapons, atomic power plants for propulsion, and radiological warfare materials are unlikely during the period. The availability of atomic weapons for general strategic use and possibly for tactical use will greatly increase the already substantial Soviet offensive capability. As quantities of these weapons increase, the Soviets are likely to place more emphasis on means for offensive delivery in order to realize maximum benefit from these weapons. However, the possible development of tactical atomic weapons will add substantially to defensive capabilities as well.

54. One of the most significant capabilities possessed by the Soviet Bloc is the capability for sabotaging animals and crops with biological warfare agents. A concerted, widespread and selective attack on the meat, poultry and dairy animals of the U.S., which might be accomplished by a small group, could cause substantial economic damage before the U.S. was aware it had been attacked in this fashion. Similarly, crops could be sabotaged with resultant similar damage. A major byproduct of such an attack would be the accompanying confusion in trade due to embargoes and other actions.

55. The capability to hamper long-range radio communications might, at a critical stage, be decisive. Other electronic countermeasures affecting radio and radar could interfere seriously with U.S. offensive air operations.

56. The capability to employ new and conventional submarines, in conjunction with mines, will continue to pose a serious threat to sea-borne transport.

57. The increasing Soviet air defense capabilities, while not yet believed fully effective at all times, is now a serious threat to our ability to deliver atomic weapons on targets deep within the USSR. As this defense increases in effectiveness during the period of the estimate, the USSR may consider the U.S. atomic capability is no longer the major deterrent to their initiation of war.

D. Soviet Bloc Military Strength and Capabilities

58. Soviet Bloc Atomic Inventory

It is estimated that the Soviet atomic weapon stockpile of fission weapons (30-100 KT) will be as follows:

mid-1952 - 50
mid-1953 - 100

These estimates are based on nominal weapon types and may be in error by as much as a factor of two.